Attorney Docket No.: 998-765

VEHICLE FLOOR COVERING WITH INTEGRAL THREADED DRAIN TUBE AND METHOD OF MAKING SAME

Field of the Invention

The present invention relates generally to floor coverings and, more particularly, to floor coverings for vehicles.

Background of the Invention

Vehicle manufacturers typically provide some type of covering for vehicle floors. Vehicle floor coverings are typically configured to provide a resilient and decorative wearing surface with heat insulating and sound deadening qualities. For example, the use of carpet as a vehicle floor covering is well known. Carpeting used to cover a vehicle floor is typically molded into a contoured configuration that conforms to the contour of a vehicle floor so as to fit properly. U.S. Patent No. 4,579,764 to Peoples, Jr., et al. discloses an exemplary molded foam-backed carpet for use as a vehicle floor covering.

The use of molded thermoplastic polymer compositions as floor coverings for vehicles known as sport utility vehicles (SUVs), which recently have

found growing popularity among consumers, is also known. U.S. Patent No. 5,322,335 to Niemi discloses an exemplary molded floor covering for an SUV.

It is known that water can accumulate on the floors of passenger and cargo compartments of vehicles, particularly during inclement weather. Because of the potential for corrosion and other damage that may be caused by such water accumulation, drain holes are conventionally provided within vehicle floors to enable any collected water to drain out. In order to prevent the infiltration of noise and dirt within a vehicle during vehicle operation, these drain holes are conventionally fitted with removable plugs.

Many conventional floor coverings, particularly floor coverings for SUVs, are formed from material that is impervious to water. As a result, water that accumulates on a vehicle floor covering may be prevented from draining from the vehicle via drains provided within the vehicle floor. Accordingly, there is a need for providing a mechanism that allows water to drain directly through vehicle floor coverings.

Summary of the Invention

In view of the above, it is an object of the present invention to facilitate drainage of water from within a vehicle directly through a vehicle floor covering.

It is another object of the present invention to provide a method of producing vehicle floor coverings having drains integrally formed therewith.

These and other objects of the present

invention are provided by a molded floor covering for a vehicle floor that includes a thermoplastic polymer layer with a contoured configuration adapted to conform to the contour of a vehicle floor and an integral, threaded drain tube extending outwardly therefrom. The drain tube extends outwardly from the thermoplastic polymer layer and includes an open proximate end, an open distal end and a threaded cylindrical bore. The open proximate end is integrally formed with the thermoplastic polymer layer and the distal end is configured to extend through an aperture in a vehicle floor when the floor covering is installed within a vehicle.

A drain plug including a head and a threaded shank connected to the head is configured to be inserted within the drain tube. The threaded shank is configured to threadingly engage the threaded cylindrical bore such that the drain plug can be inserted and removed via rotation about the axial direction. Preferably, the drain plug head and the drain tube proximate end have respective conical frustum shapes such that the drain plug head can be received by the proximate end in countersunk relation therewith. Furthermore, it is preferable that the drain plug head include a portion that can be engaged by a tool or grasped by a user to rotate the drain plug about the axial direction.

According to another aspect of the present invention, a method is provided for producing a molded floor covering for a vehicle floor that includes a drain tube integrally formed therewith. A mold having a

contour of a vehicle floor is provided with an outwardly projecting threaded member. The threaded member includes a head portion and an elongate threaded shank. A layer of thermoplastic polymer is vacuum formed over the mold and around the threaded member such that the layer follows the contours of the mold and threaded member to produce a molded floor covering having opposite first and second surfaces, and a drain tube extending outwardly therefrom. The drain tube includes a threaded bore that is configured to receive a correspondingly-threaded drain plug. The drain tube includes an open proximate end and a closed distal end. The open proximate end is integrally formed with the molded floor covering.

According to another embodiment of the present invention, a fastener may threadingly engage an elongate threaded tube integrally formed with a floor covering according to the above described method to removably secure a mat to the floor covering.

Brief Description of the Drawings

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain principles of the invention.

Fig. 1 is a perspective view showing an exemplary molded floor covering assembly for a vehicle incorporating an integral drain in accordance with the invention.

Fig. 2 is an exploded, cutaway view of a portion of the floor covering of **Fig. 1** having an integral drain and plug therein according to the invention.

Fig. 3 is a side section view of a portion of the floor covering of **Fig. 1** illustrating the plug in a secured position within the drain tube.

Fig. 4 illustrates method steps for producing molded floor coverings according to the present invention.

Fig. 5 is a side section view of a layer of thermoplastic polymer being vacuum formed over a mold and around a threaded member in accordance with the present invention.

Fig. 6 is a side section view of a molded vehicle floor covering wherein water is shown draining through the drain tube.

Fig. 7A is a side section view of a layer of thermoplastic polymer being vacuum formed over a mold and around a threaded member having a threaded insert in accordance with another embodiment of the present invention.

Fig. 7B illustrates the plug of Fig. 7A in a secured position threadingly engaged with the threaded insert within the drain tube.

Fig. 8 is a side section view of a molded floor covering for a vehicle floor according to another embodiment of the present invention wherein the floor covering includes an elongate tube and a fastener for securing a mat to the floor covering.

Fig. 9 is a perspective view of a drain plug having a handle that facilitates removal of the drain plug by hand.

Detailed Description of the Invention

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

Referring now specifically to **Fig. 1**, reference character **10** generally indicates a vehicle floor covering incorporating a drain **15** in accordance with the invention. The floor covering **10** illustrated in **Fig. 1** has a nonplanar three dimensional molded configuration adapted to fit the front seat compartment floor of a vehicle and includes a raised medial portion **11** adapted to conform to the transmission hump, generally vertically extending side portions **12** adapted to fit beneath each door opening, and a front portion **13** adapted to fit along the inclined floorboard and vertical firewall areas of a vehicle. Various openings or cut-outs are provided, as indicated at **14**, to receive air conditioning equipment, the steering column, pedals and the like. Drains **15** having removable

plugs 16 secured therewithin according to the invention are provided in selected low point areas 17 of the floor covering 10. It is to be understood that the particular three dimensional configuration illustrated is merely for purposes of illustration. Vehicle floor coverings incorporating drains according to the present invention may have various configurations and shapes depending on the floor configuration of a vehicle.

Referring now to **Fig. 2**, an exploded, cutaway view of a portion of the floor covering **10** having a drain **15** and plug **16** therein, according to the invention, is illustrated. The floor covering **10** includes an exposed surface **10a** and an opposite underside surface **10b**. When the floor covering **10** is installed in a vehicle, the underside surface **10b** is configured to make contacting relationship with the vehicle floor **18**. As would be understood by one of skill in the art, the floor covering **10** may be secured to the floor **18** via adhesives and/or fasteners.

The illustrated drain **15** includes a drain tube **20** that is integrally formed with the floor covering **10** and that extends downwardly from the underside surface **10b** of the floor covering **10**. The drain tube **20** is configured to extend through an aperture **19** formed within the vehicle floor **18** when the floor covering **10** is installed within a vehicle.

The drain tube **20** includes a cylindrical inner wall **21** that defines a cylindrical bore **22** that extends along an axial direction **A**. The cylindrical bore **22** extends from an open proximate end **20b** to an open distal end **20a**, as illustrated. The illustrated

proximate end **20b** has a conical frustum shape that is configured to receive a correspondingly-shaped head of the plug **16** in countersunk relation therewith. The drain tube cylindrical inner wall **21** includes a set of threads **25** which are configured to threadingly receive a correspondingly threaded shank **31** of the plug **16**.

Still referring to **Fig. 2**, the plug **16** has a head portion **30** with an aperture **34** configured to receive a tool for applying torque thereto and a circular, threaded shank portion **31**. It is understood that the head portion **30** may have various configurations. For example, the head portion **30** may include a handle (**35**, **Fig. 9**) that facilitates removal of the plug **16** by hand, without the need for a tool. Also, projections extending from the head portion **30**, as well as apertures, may serve as means for engaging a tool that is configured to rotate the drain plug **16**. The plug **16** may be formed from various materials including, but not limited to, metals, plastics and rubber. Preferably, the plug **16** is formed from plastic or rubber to facilitate easy removal by hand without the need for a removal tool.

The head portion **30** has a conical frustum shape and includes a substantially flat end portion **30a**. Accordingly, when the plug **16** is secured within the drain **15**, the plug head portion **30** is countersunk within the proximate end **20b** such that the end portion **30a** is substantially flush with the exposed surface **10a** of the floor covering, as illustrated in **Fig. 3**.

The threads **32** on the shank are configured to threadingly engage with the threads **25** in the drain

tube cylindrical inner wall **21** such that when torque is applied to the plug head portion **30**, the plug **16** moves along the axial direction **A** within the drain tube **20**. Preferably, rotation of the plug **16** in a clockwise direction causes the plug **16** to move along the axial direction **A** so that the plug head portion **30** moves towards the inlet **23**. Conversely, rotation of the plug **16** in a counter-clockwise direction causes the plug **16** to move along the axial direction **A** so that the plug head portion **30** moves away from the inlet **23**.

Fig. 3 illustrates the plug **16** in a secured position within the drain tube **20**. To remove water that has accumulated on the floor covering exposed surface **10a**, the plug **16** is rotated in a counter-clockwise direction which threadingly disengages the threaded shank **31** from the threaded bore **22**, thereby allowing the plug **16** to be removed from the drain **15**. The accumulated water can then drain from the vehicle through the drain tube **20**. After the water is drained from the vehicle, the plug **16** is returned to a secured position within the drain **15** as illustrated in **Fig. 3**.

Referring now to **Figs. 4** and **5**, a method of producing a molded floor covering for a vehicle floor, wherein the molded floor covering includes a drain tube integrally formed therewith according to the present invention is illustrated. A mold having a contour of a vehicle floor is provided with an outwardly projecting threaded member (Block **100**). A metal bolt is preferably utilized as the threaded member. **Fig. 5** is a section view of a mold **40** having a contour of a vehicle floor. An outwardly projecting threaded member **16** is also

provided, as illustrated. The illustrated threaded member **16** has a head portion **30** with a conical frustum shape and an elongate threaded shank **31**.

A layer of thermoplastic polymer is then vacuum formed over the mold and around the threaded member such that the layer follows the contours of the mold and threaded member (Block **102**). Various polymers or copolymers may be suitably employed as the thermoplastic polymer such as, for example, polymers or copolymers of ethylene with ethylenically unsaturated monomers; fillers; polyolefin polymers such as polyethylene or polypropylene; polyvinyl chloride; styrenebutadiene mixed polymers and mixtures of these materials with other thermoplastic polymers. A preferred thermoplastic polymer is ethylene/vinyl acetate copolymer. The polymer may include conventional fillers, plasticizers, processing aids, flame retardants, etc., the selection of which is within the skill of one in the art.

As illustrated in **Fig. 5**, the layer of thermoplastic polymer **45** has been formed via mold **40** to produce a molded floor covering **10** having opposite first and second surfaces **10a, 10b** and a drain tube **20** extending outwardly therefrom. The drain tube **20** includes a threaded bore **21** with an open proximate end **20b** and a closed distal end **20a**. The open proximate end **20b** is integrally formed with the molded floor covering **10**. In the illustrated embodiment, the open proximate end **20b** has a conical frustum configuration matching that of the head **30** of the threaded member **16**.

Next, the threaded member is rotated to

threadingly disengage the threaded member from the drain tube (Block **104**). An opening is then formed through the drain tube distal end (Block **106**). Accordingly, fluid, such as water **50**, can drain from the molded floor covering first surface **10a** by flowing into the open proximate end **20b**, through the drain tube **20**, and out the open distal end **20a**, as illustrated in **Fig. 6**. Preferably, a plastic threaded bolt is threadingly engaged with the drain tube to serve as the drain tube plug. Preferably, the plastic threaded bolt has a handle (**35**, **Fig. 9**) to allow users to manually rotate the plastic bolt in order to threadingly disengage the plastic bolt from the drain tube.

Additional post-forming operations may be performed on the floor covering (Block **108**). Such operations may include, but are not limited to, the addition of padding to the underside surface **10b** of the molded floor covering **10** for providing cushioning, sound deadening, and thermal insulation, and the addition of carpeting to the exposed surface **10a** of the molded floor covering **10**.

As would be known to one of skill in the art, padding may be formed from relatively inexpensive fibers such as jute or recycled waste fibers, and may be precut into predetermined desired shapes and bonded to the underside surface **10b** of the floor covering **10**. Carpeting added to the exposed surface may suitably be of tufted, woven, knitted, or nonwoven construction in accordance with known methods of carpet manufacture.

Referring now to **Figs. 7A** and **7B**, another embodiment of the present invention is illustrated.

A threaded sleeve **60** is threadingly engaged with the threaded member **16** prior to forming the molded floor covering **10**. The purpose of the threaded sleeve **60** is to eliminate the potential for stripping and other thread damage during and after the molding process. In the illustrated embodiment, the layer of thermoplastic polymer **45** has been formed via mold **40** to produce a molded floor covering **10** having opposite first and second surfaces **10a, 10b** and a drain tube **20** extending outwardly therefrom. The drain tube **20** includes an open proximate end **20b** and a closed distal end **20a**. The threaded insert **60** is integrally formed with the layer of thermoplastic polymer **45**. The threaded insert **60** may include outwardly projecting members, such as ribs or threads, on the outer surface thereof to facilitate bonding with the floor covering **10** during formation of the elongate tube **20**. **Fig. 7B** illustrates the plug **16** in a secured position threadingly engaged with the threaded insert **60** within the drain tube **20**.

Referring now to **Fig. 8**, a molded floor covering **110** for a vehicle floor, according to another embodiment of the present invention is illustrated. The floor covering **110** has opposite first and second surfaces **110a, 110b**, and an elongate tube **120** extending outwardly therefrom, as illustrated. The elongate tube **120** includes a distal end **120a** and an open proximate end **120b** with a cylindrical inner wall **121** that defines a cylindrical bore **122** having an axial direction **A** extending from the open proximate end **120b** to the distal end **120a**. The open proximate end **120b** is integrally formed with the floor covering **110** and the

elongate tube **120** is configured such that the distal end **120a** can extend through an aperture (not shown) within a vehicle floor.

Preferably, a threaded insert **160** is integrally formed with the cylindrical inner wall **121** within the cylindrical bore **122** as illustrated. The threaded insert **160** may include outwardly projecting members, such as ribs or threads, on the outer surface **162** thereof to facilitate bonding with the floor covering **110** during formation of the elongate tube **120**. A fastener **170** that is configured to compressively engage a portion of a mat **180** disposed on the floor covering **110** is threadingly engaged with the threaded insert **160**. The fastener **170** includes a head **171** having a circumferentially extending shoulder **172** that is configured to compressively engage a portion of the mat **180** disposed on the floor covering **110**. The fastener **170** also includes a threaded shank **173** that is connected to the head **171** and that is configured to threadingly engage the threaded insert **160**.

In the illustrated embodiment, the fastener **170** also includes neck portion **174** between the head **171** and the threaded shank **173**. The fastener neck portion **174** has a conical frustum shape. The proximate end **120b** of the elongate tube **120** has a corresponding conical frustum shape that is configured to receive the neck portion **174** in countersunk relation therewith, as illustrated. The fastener **170** allows a mat to be quickly secured to and removed from the floor covering **110**.

The foregoing is illustrative of the present

invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the appended claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.